

WHAT IS CLAIMED IS:

1. A method of rejecting nitrogen from a feed gas stream comprising methane and nitrogen so as to form a methane product, comprising cooling the feed gas stream in a main heat exchanger, rectifying the cooled feed gas stream in a double rectification column comprising a higher pressure rectification
5 column, a lower pressure rectification column, and a first condenser-reboiler, the first condenser-reboiler placing the top region of the higher pressure rectification column in heat exchange relationship with a bottom region of the lower pressure rectification column, recycling a flow of gas from the lower pressure rectification column to the higher pressure rectification column, the
10 recycle gas flow being warmed, a first part of the warmed recycle gas being compressed to a first pressure, cooled, and introduced at least in part into the higher pressure rectification column, withdrawing a product methane stream in liquid state from the lower pressure rectification column, raising the pressure of the liquid product methane stream, and vaporising the liquid
15 product methane stream, wherein a second part of the warmed recycle gas flow is compressed to a second pressure lower than the first pressure, is cooled, and is condensed in a second condenser-reboiler associated with an intermediate mass exchange region of the lower pressure rectification column.
2. The method according to claim 1, wherein a vent stream is taken from the recycle stream and is vented.
3. The method according to claim 2, additionally including the step of controlling the size of the recycle stream that is vented.
4. The method according to claim 1, in which said first pressure is above the critical pressure of the recycle gas, and the first part of the recycle flow is cooled in the main heat exchanger to sufficiently low a temperature that it is

liquefied on being expanded to the operating pressure of the higher pressure
5 rectification column.

5. The method according to claim 1, in which the entire first part of the recycle gas flow is introduced into the higher pressure rectification column.
6. The method according to claim 1, in which at least 75% of the feed gas stream is liquefied upstream of the higher pressure rectification column.
7. The method according to claim 6, in which the partially liquefied feed stream is subjected to phase separation, at least part of the resulting liquid phase being introduced into an intermediate mass exchange region of the higher pressure rectification column, and the vapour phase being introduced into the bottom of the higher pressure rectification column.
8. The method according to claim 1, in which the pressurised liquid product methane stream is warmed without being vaporised in a further heat exchanger upstream of its vaporisation in the main heat exchanger.
9. The method according to claim 1, in which both parts of the recycle gas flow are compressed in the same plural stage compressor.
10. Apparatus for rejecting nitrogen from a feed gas stream comprising methane and nitrogen so as to form a methane product, comprising a main heat exchanger for cooling the feed gas stream, a double rectification column rectifying the cooled feed gas stream, the double rectification column comprising a higher pressure rectification column, a lower pressure rectification column, and a first condenser-reboiler operable to place a top region of the higher pressure rectification column in heat exchange relationship with a bottom region of the lower pressure rectification column, a plurality of pathway for recycling vapour from the lower pressure rectification
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- 10 column to the higher pressure rectification column, the pathways comprising a first higher pressure pathway, comprising in sequence warming passages, compression means, and cooling passages, and a second lower pressure pathway comprising, in sequence, warming passages, compression means, cooling passages and a second condenser-reboiler, the second condenser-reboiler being in heat exchange relationship with an intermediate mass
- 15 exchange region of the lower pressure rectification column, a pump for withdrawing liquid methane product from a bottom region of the lower pressure rectification column, and a heat exchange means for vaporising the methane product.
11. The apparatus according to claim 10 in which the said heat exchange means for vaporising the methane product is the main heat exchanger itself.
12. The apparatus according to claim 10, wherein the cooling and warming passages of the first and second pathways are provided by the main heat exchanger.
13. The apparatus according to claim 12, in which the first and second pathways share common warming passages.